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**BART SAN FRANCISCO AIRPORT EXTENSION/CALTRAIN UPGRADE  
AA/DEIS**

**COST-EFFECTIVENESS MEASURES**

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**February, 1990**

**Metropolitan Transportation Commission  
101 Eighth Street  
Oakland, CA 94607**

**(7033p)**



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## PURPOSE

This memo describes the basis for the cost-effectiveness calculations provided in Phase 1 of the BART/CalTrain Upgrade AA/DEIS--particularly the derivation of the factors for capital costs, O&M costs, new riders, travel time savings, and hours of user benefit. These factors are the components of the two major capital investment indices used by UMTA to make major capital investment decisions:

- New Rider Index
- User Benefit Index

## THE DEFINITION OF THE TSM ALTERNATIVE

The TSM alternative provides the reference point for the comparison of system productivity. While two definitions of the TSM were initially defined, the preferred definition from both a technical and policy standpoint is the TSM alternative which provides improved headways and feeder bus service to BART's Daly City Station but does not extend BART beyond this station; this TSM alternative also upgrades CalTrain service on the Peninsula from 52 to 66 trains a day and includes CalTrain projects needed to sustain the service beyond 1992 when the State's involvement in managing the service is terminated. We believe the cost-effectiveness evaluation of the full 4-station BART extension to the Airport is appropriate for two reasons: 1) the full extension is needed to support the MTC Regional Rail Agreement and the high local "overmatch" attached to this agreement, and 2) segmentation of the line into two extensions--one to Colma and one beyond Colma-- does not adequately capture the productivity benefits of the total project.

## CAPITAL COSTS

- Capital costs are taken from the Capital Cost Review Report, February, 1990 and are reported in 1989 dollars. Construction cost estimates for each alternative are included in Attachment A.
- Cost add-on's are assumed as follows: Engineering & Construction Management (15%), Owner Administration (2%), and Contingencies (15%-30%). The contingencies vary depending on the difficulty and risk of the type of work being performed as well as the current level of conceptual design.
- Annualization factors for facilities, rolling stock, buses, right-of-way, etc. are those in UMTA's guidance.

## OPERATING COSTS

- Operating costs were taken from the O&M Cost Estimates Report, January, 1990; cost estimates are based on various operator cost buildup models developed by Manuel Padron & Associates.
- Attachment B contains a summary of the O&M cost estimates.



#### RIDERSHIP ESTIMATES/NEW RIDERS

- MTC developed year 2005 ridership estimates for the Build and TSM alternatives; the results are transmitted to UMTA in a February 28, 1990 letter from Chuck Purvis.
- The daily work trip annualization factor used is 260.
- The daily non-work trip annualization factor used is 345.
- Air passenger trips were estimated using a separate mode choice model developed by Greig Harvey and previously submitted to UMTA for information and review; air passenger transit trips are conservatively estimated to be 6-8% of daily ground trips to/from San Francisco Airport.
- The air passenger annualization factor is 365.
- Air passenger trips are increased 10%, based on the observed passenger/accompanion ratio in the 1985 MTC air passenger survey data base.
- MTC calculates new riders using the UEVAL software package.
- Attachment C summarizes the information on new riders for each alternative.

#### MONETARY BENEFITS OF TRAVEL TIME SAVINGS FOR EXISTING RIDERS

- The value of time for work and non-work trips is \$4.00 and \$2.00 per hour, respectively (1984 values).
- The 1985 MTC air passenger survey shows the average value of travel time for air passengers is in excess of \$17 per hour; however, a conservative value of \$4.00 per hour has been used as specified by UMTA.
- Annual travel time savings monetary equivalents for work, non-work, and air passenger trips are shown in Attachment C.

#### HOURS OF USER BENEFIT

- MTC used the UEVAL software package to calculate travel time savings (consumer surplus) for new and existing transit riders for work and non-work trips.
- Travel time savings for air passengers and companions were estimated separately by Greig Harvey.
- Attachment C summarizes the results.

#### ALTERNATIVE ASSUMPTIONS FOR COST-EFFECTIVENESS

- MTC is providing cost-effectiveness information under two different assumptions as explained below.
- CASE A is the standard set of index value assumptions advocated by UMTA in the AA Guidance; however, CASE A creates several inherent biases which, if not recognized, would lead to an unfavorable treatment of Bay Area transit projects in comparison to projects advanced by other cities.

- CASE B is the approach we advocate until the UMTA Major Capital Investment Guidelines are revised (Federal Register, April 25, 1989). This approach recognizes significant differences in the construction cost and transit operating costs between individual metropolitan areas and adjusts these values to create a level playing field for measuring the productivity of future rail investments. Attachment D has been presented to UMTA before and illustrates the divergence in construction and transit operating costs between various "AA" cities. These differences tend to bias the index in a manner which probably was not intended by the developers of the cost-effectiveness criteria. Therefore, to remove the effect of local economies on the indices, we prefer that UMTA normalize the CE index by multiplying the ratio of the local construction/O&M index to the average national value by the calculated construction/O&M cost ( $100/125 \times \text{Capital cost}$ ;  $12.6/14.9 \times \text{O\&M cost}$ ).
- Cost-effectiveness results are provided in Tables 1 and 2.

#### OTHER COMMENTS

While a considerable amount of effort has gone into generating the above cost-effectiveness indices, policy bodies interested in specific modal issues have not "officially" endorsed the cost-effectiveness conclusions because of concerns over future funding eligibility. Specifically, the CalTrain Upgrade cost-effectiveness numbers have not been endorsed by the Joint Powers Board, which is conducting the CalTrain Downtown Terminal Relocation Study EIS, or the Policy Board for this AA. Additional investigation of certain patronage and cost assumptions would be necessary before their endorsement could be anticipated.



Table 1  
CASE A - BASELINE  
(Numbers in Millions)

	BART - EXTERNAL	BART - INTERNAL	CALTRAIN - ELECTRIFIED	CALTRAIN - DIESEL	LRT	BART + CALTRAIN ELECTRIC	BART + CALTRAIN DIESEL
<u>NEW RIDER INDEX</u>							
o Capital Cost (\$)	46.69	80.99	116.59	108.63	74.14	153.41	139.49
o O&M Cost (\$)	12.53	13.15	41.79	37.47	12.54	49.96	45.64
o Travel Time Savings (\$)							
- Work & Non-Work	-6.32	-6.32	-11.38	-11.38	-5.60	-12.71	-12.71
- Air Pass.	-1.30	-1.58	-.88	-.88	-1.65	-1.71	-1.71
Subtotal (Numerator)	51.72	86.24	146.12	133.84	79.43	188.95	170.71
o Annual New Riders							
- Work & Non-Work	2.64	2.64	4.15	4.15	3.20	4.73	4.73
- Air Pass.	1.55	1.98	1.20	1.20	2.13	2.32	2.32
Sub-Total (Denominator)	4.19	4.62	5.35	5.35	5.33	7.05	7.05
INDEX VALUE	12.34	18.67	27.31	25.02	14.90	26.80	24.21
<u>USER BENEFIT INDEX</u>							
o Capital Cost (\$)	46.69	80.99	116.59	108.63	74.14	153.41	139.49
o O&M Cost (\$)	12.53	13.15	41.79	37.47	12.54	49.96	45.64
Sub-Total (Numerator)	59.22	94.14	158.38	146.10	86.68	203.37	185.13
o Hours of User Benefit							
- Work & Non-Work	2.81	2.81	3.77	3.77	3.15	4.00	4.00
- Air Pass.	.94	1.31	.50	.50	1.40	1.54	1.54
Sub-Total (Denominator)	3.75	4.12	4.27	4.27	4.55	5.54	5.54
INDEX VALUE	15.79	22.85	37.09	34.22	19.05	36.71	33.42

Table 2  
CASE B - ADJUSTED CONSTRUCTION/O&M COSTS  
(Numbers in Millions)

	BART - EXTERNAL	BART - INTERNAL	CALTRAIN - ELECTRIFIED	CALTRAIN - DIESEL	LRT	BART + CALTRAIN ELECTRIC	BART + CALTRAIN DIESEL
<b>NEW RIDER INDEX</b>							
o Capital Cost (\$)	37.35	64.79	93.27	86.90	59.31	122.73	111.59
o O&M Cost (\$)	10.65	11.18	35.52	31.85	10.66	42.47	38.79
o Travel Time Savings (\$)							
- Work & Non-work	-6.32	-6.32	-11.38	-11.38	-5.60	-12.71	-12.71
- Air Pass.	-1.30	-1.58	- .88	- .88	-1.65	-1.71	-1.71
Subtotal (Numerator)	40.38	68.07	116.53	106.49	62.72	150.78	135.96
o Annual New Riders							
- Work & Non-work	2.64	2.64	4.15	4.15	3.20	4.73	4.73
- Air Pass.	1.55	1.98	1.20	1.20	2.13	2.32	2.32
Sub-Total (Denominator)	4.19	4.62	5.35	5.35	5.33	7.05	7.05
INDEX VALUE	9.63	14.73	21.78	19.90	11.77	21.38	19.29
<b>USER BENEFIT INDEX</b>							
o Capital Cost (\$)	37.35	64.79	93.27	86.90	59.31	122.73	111.59
o O&M Cost (\$)	10.65	11.18	35.52	31.85	10.66	42.47	38.79
Sub-Total (Numerator)	48.00	75.97	128.79	118.75	69.97	165.20	150.38
o Hours of User Benefit							
- Work & Non-work	2.81	2.81	3.77	3.77	3.15	4.00	4.00
- Air Pass.	.94	1.31	.50	.50	1.40	1.54	1.54
Sub-Total (Denominator)	3.75	4.12	4.27	4.27	4.55	5.54	5.54
INDEX VALUE	12.80	18.44	30.16	27.81	15.38	29.82	27.14





## ATTACHMENTS





# ATTACHMENT A

BART - SAN FRANCISCO AIRPORT - CALTRAIN UPGRADE AA/DEIS

TABLE 1  
SUMMARY OF MAJOR COST ITEMS  
ALL \$\$\$ X 1,000,000  
February 27, 1990

ALTERNATIVE	BART	AMOUNT	CalTrain	AMOUNT	Muni	AMOUNT	FEEDER SYSTEM	AMOUNT	TOTAL
TSM 1			0 Move to 7th & Channel (3) \$16.7 0 Service to Gilroy (1) \$34.0 0 Track Improvements (1) \$40.0 0 SFO Station \$8.0 0 San Bruno Station \$4.0 0 Cahill/Alme Extension (1) 16.6 0 Grade Separations (2) \$243.9 0 R-O-W Purchase 180 0 Maintenance Yard (1) \$58.0 0 Station Acquisition (4) \$13.0 Total \$434.2		0 Muni Extension to 7th/Channel \$60.4 0 11 MUNI Buses \$1.7 0 22 METRO Vehicles \$30.8 Total \$92.9		0 34 SamTrans Buses \$5.1 Total \$5.1	\$532.1	
TSM 2	0 Colma Station plus Turnback \$91.2 0 Maintenance Vehicles/Equip. \$5.0 Total \$96.2		0 As TSM 1 \$434.2 Total \$434.2		0 As TSM 1 \$92.9 Total \$92.9		0 12 SamTrans Buses \$1.8 Total \$1.8	\$625.1	
4A	0 Facilities \$2.8 0 Stations (5) \$143.1 0 Major Structures \$87.9 0 Trackwork/Guidance \$33.6 0 Surface Modifications \$4.2 0 Utility Relocation \$10.6 0 Systems & Equipment \$47.8 0 R-O-W Acquisition \$25.9 0 Rolling Stock (46 Vehicles) (7) \$69.0 0 Maintenance Vehicles/Equip. \$20.0 Total \$444.9		0 As TSM 1 \$434.2 Total \$434.2		0 As TSM 1 \$92.9 Total \$92.9		0 7 SamTrans Buses (includes SFO Shuttle) \$1.1 Total \$1.1	\$973.0	
4B	0 Facilities \$0.9 0 Stations (6) \$251.1 0 Major Structures \$302.8 0 Trackwork/Guidance \$40.6 0 Surface Modifications \$4.0 0 Utility Relocation \$8.0 0 Systems & Equipment \$54.0 0 R-O-W Acquisition \$17.6 0 Rolling Stock (46 Vehicles) (7) \$69.0 0 Maintenance Vehicles/Equip. \$20.0 Total \$768.0		0 As TSM 1 \$434.2 Total \$434.2		0 As TSM 1 \$92.9 Total \$92.9		0 7 SamTrans Buses \$1.1 Total \$1.1	\$1,296.1	

BART - SAN FRANCISCO AIRPORT - CALTRAIN UPGRADE AA/DEIS

TABLE 1  
SUMMARY OF MAJOR COST ITEMS  
ALL \$\$\$ X 1,000,000  
February 27, 1990

ALTERNATIVE	BART	AMOUNT	Caltrain	AMOUNT	Muni	AMOUNT	FEEDER SYSTEM	AMOUNT	TOTAL
5B-1	O Colma Station plus Turnback O Maintenance Vehicles/Equip.	\$91.2 \$5.0	(ELECTRIFICATION ALTERNATIVE) O As TSM 1 O Less 7th & Channel Relocation O 2nd & Market St. Station (3) Incl. Bay Shore Yard O Extra Grade Separations SCDT O Grade Separ. San Mateo Cty (2) O Station/Parking Improv. (1) O Utility Relocation O Surface Improvements O Electrification O Train Control & Signalling O Rolling Stk. (30 Locos 52 Cars) O Palou Station (New) O Brisbane Station (New) O Maintenance Vehicles/Equip. O Centralized Traf. Control (1)	\$434.2 (\$16.7) \$450.0  \$50.0 \$83.2 \$19.8 \$40.0 \$28.0 \$90.1 \$14.9 \$192.8 \$2.0 \$2.0 \$20.0 \$24.0	O MUNI Extension to 7th/Channel O 22 METRO Vehicles	\$60.4 \$30.8	O 26 SamTrans Buses	 \$3.9	
	Total	\$96.2	Total	\$1,434.3	Total	\$91.2	Total	\$3.9	\$1,625.6
5B-2	O Colma Station plus Turnback O Maintenance Vehicles/Equip.	\$91.2 \$5.0	(DIESEL ALTERNATIVE) O As 5B-1 O Less Utility Reloc. @ 50% O Less Surface Improv. @ 50% O Less Electrification O Less Train Cont. & Signal. O Less Elect. Rolling Stock O Rolling Stk. (36 Locos 72 Cars) O Maint. Vehic./Equip @ 50%	\$1,434.3 (\$20.0) (\$14.0) (\$90.1) (\$14.9) (\$192.8) \$266.4 (\$12.0)	O As 5B-1		O As 5B-1		
	Total	\$96.2		\$1,356.9	Total	\$91.2	Total	\$3.9	\$1,548.2
6B-1	O As 4A	\$444.9	(ELECTRIFICATION ALTERNATIVE) O As 5B-1	\$1,434.3	O As 5B-1	\$91.2	O 16 SamTrans Buses	\$2.4	
	Total	\$444.9	Total	\$1,434.3	Total	\$91.2	Total	\$2.4	\$1,972.8
6B-2	O As 4A	\$444.9	(DIESEL ALTERNATIVE) O As 5B-2	\$1,356.9	O As 5B-2	\$91.2	O As 6B-1	\$2.4	
		\$444.9		\$1,356.9	Total	\$91.2	Total	\$2.4	\$1,895.4



BART - SAN FRANCISCO AIRPORT - CALTRAIN UPGRADE AA/DEIS

TABLE 1  
SUMMARY OF MAJOR COST ITEMS  
ALL \$\$\$ X 1,000,000  
February 27, 1990

ALTERNATIVE	BART	AMOUNT	Caltrain	AMOUNT	Muni	AMOUNT	FEEDER SYSTEM	AMOUNT	TOTAL
7-1 LRT Option	0 Colma Station plus Turnback 0 Maintenance Vehicles/Equip.	\$91.2 \$5.0	(LRT ALTERNATIVE) 0 As TSM 1 0 Less Service To Gilroy 0 Van Ness Avenue Turnback 0 Freight Track 0 Freight Track - Signals 0 Freight Track - Structures 0 Freight Track - Tunnel Improv. 0 Passing Track - Trackwork 0 Passing Track - Elect & Sig 0 Tunnel Modifications 0 Station Modifications 0 Palou Station (New) 0 Brisbane Station (New) 0 Utility Relocation 0 Surface Improvements 0 Electrification 0 Train Control/Signalling 0 Maint. Yard - Minor (Incl ROW) 0 Rolling Stock (79 Vehicles) 0 Maintenance Vehicles/Equip. 0 Centralized Traffic Control	\$434.2 (\$34.0) \$10.0 \$53.2 \$6.0 \$60.0 \$71.8 \$6.0 \$0.6 \$50.7 \$19.8 \$2.0 \$2.0 \$40.0 \$28.0 \$90.1 \$14.9 \$25.0 \$110.6 \$20.0 \$24.0	0 11 MUNI Buses 0 36 METRO Vehicles 0 MUNI Extension to 7th/Channel	\$1.7 \$50.4 \$60.4	0 26 SanTrans Buses	\$3.9	
	Total	\$96.2	Total	\$1,034.9	Total	\$112.5	Total	\$3.9	\$1,247.5
7-2 LRT Option Freight Trk	0 As 7-1	\$96.2	(LRT OPTION W/O FREIGHT TRACK REQUIREMENTS) 0 Less Freight Trk. Rqmts.	(\$191.0)	0 As 7-1	\$112.5	0 As 7-1	\$3.9	
	Total	\$96.2	Total	\$843.9	Total	\$112.5	Total	\$3.9	\$1,056.5

LEGEND: (1) Caltrain 5 Year Plan 1989  
(2) San Mateo County Transportation Authority 1989  
(3) Downtown Station Relocation Study MKE October 1989  
(4) Caltrans Estimate  
(5) Includes Colma, Chestnut, Tanforan and SFO External Station  
(6) Includes Colma, Chestnut, Tanforan and SFO Internal Station  
(7) From Manuel Padron Assoc. O&M Cost Estimate Report January 8, 1990

# ATTACHMENT B

## BART SAN FRANCISCO AIRPORT EXTENSION/CALTRAIN UPGRADE AA/DEIS

### O&M COST ESTIMATION SUMMARY (1)

OPERATING AGENCY		ALT. 1 NO-ACTION	ALT. 2A TSM-1	ALT. 2B TSM-2	ALT. 4A BART-SFO	ALT. 4B BART-SFO	(9) ALT. 5B CALTRAIN	(10) ALT. 5B CALTRAIN	(9) ALT. 6B FULL BUILD	(10) ALT. 6B FULL BUILD	ALT. 7 LRT
=====		=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
CALTRAIN	(2)	\$31.76	\$35.59	\$35.42	\$35.50	\$35.50	\$74.28	\$69.96	\$73.90	\$69.58	NA
Marginal O&M Cost:		NA	\$3.83	\$3.66	\$3.74	\$3.74	\$42.52	\$38.20	\$42.14	\$37.82	NA
BART	(3)	\$194.15	\$193.53	\$197.02	\$208.56	\$209.18	\$197.02	\$197.02	\$207.63	\$207.63	\$197.49
Marginal O&M Cost:		NA	(\$0.62)	\$2.88	\$14.42	\$15.03	\$2.88	\$2.88	\$13.49	\$13.49	\$3.34
SAMTRANS	(4)	\$40.10	\$43.50	\$42.30	\$41.09	\$41.09	\$44.28	\$44.28	\$42.22	\$42.22	\$43.90
Marginal O&M Cost:		NA	\$3.40	\$2.19	\$0.99	\$0.99	\$4.18	\$4.18	\$2.12	\$2.12	\$3.80
MUNI	(5)	\$247.18	\$259.35	\$259.35	\$259.35	\$259.35	\$258.17	\$258.17	\$258.17	\$258.17	\$270.79
Marginal O&M Cost:		NA	\$12.16	\$12.16	\$12.16	\$12.16	\$10.99	\$10.99	\$10.99	\$10.99	\$23.61
PENINSULA LRT	(6)	NA	NA	NA	NA	NA	NA	NA	NA	NA	\$32.17
Marginal O&M Cost:		NA	NA	NA	NA	NA	NA	NA	NA	NA	\$32.17
SCCTD	(7)	\$129.21	\$143.17	\$143.17	\$143.17	\$143.17	\$143.17	\$143.17	\$143.17	\$143.17	\$143.33
Marginal O&M Cost:		NA	\$13.96	\$13.96	\$13.96	\$13.96	\$13.96	\$13.96	\$13.96	\$13.96	\$14.12
TOTAL O&M COST:		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Marginal O&M Cost: (8)		\$642.40	\$675.14	\$677.26	\$687.67	\$688.29	\$716.93	\$712.61	\$725.10	\$720.78	\$637.68
		NA	\$18.78	\$20.89	\$31.31	\$31.93	\$60.57	\$56.25	\$68.74	\$64.42	\$30.74

#### NOTES:

- (1) Costs estimated in millions of FY1989 dollars.
- (2) Refer to Table 1-3. Cost estimated in FY1989 dollars.
- (3) Refer to Table 2-3. FY87 costs inflated to FY89 dollars with 4.0% annual rate.
- (4) Refer to Table 3-3. FY88 costs inflated to FY89 dollars with 4.0% annual rate.
- (5) Refer to Table 4-3. FY90 costs deflated to FY89 dollars with 4.0% annual rate.
- (6) Refer to Table 5-2. Cost estimated in FY89 dollars.
- (7) Refer to Table 6-3. Cost estimated in FY89 dollars.
- (8) Marginal cost relative to Alternative 1 ("No Action").
- (9) Electric operation of CalTrain.
- (10) Diesel operation of CalTrain.



Attachment C  
 BENEFIT MEASUREMENTS  
 (All Numbers in Millions)

	BART - EXTERNAL	BART - INTERNAL	CALTRAIN - ELECTRIFIED	CALTRAIN - DIESEL	LRT	BART + CALTRAIN ELECTRIC	BART + CALTRAIN DIESEL
<u>NEW RIDERS</u>							
o Work	2.40	2.40	4.01	4.01	2.72	4.46	4.46
o Non-Work	.24	.24	.14	.14	.48	.24	.24
o Air Passenger	1.41	1.80	1.09	1.09	1.94	2.14	2.14
o Air Passenger Related	.14	.18	.11	.11	.19	.21	.21
<b>TOTAL</b>	<b>4.19</b>	<b>4.62</b>	<b>5.35</b>	<b>5.35</b>	<b>5.33</b>	<b>7.05</b>	<b>7.05</b>
<u>TRAVEL TIME SAVINGS (\$)</u>							
o Work	5.54	5.54	9.63	9.63	4.40	10.89	10.89
o Non-Work	.78	.78	1.75	1.75	1.20	1.82	1.82
o Air Passenger	1.18	1.44	.80	.80	1.50	1.55	1.55
o Air Passenger Related	.12	.14	.08	.08	.15	.16	.16
<b>TOTAL</b>	<b>7.62</b>	<b>7.90</b>	<b>12.26</b>	<b>12.26</b>	<b>7.25</b>	<b>14.42</b>	<b>14.42</b>
<u>HOURS OF USER BENEFIT (hrs.)</u>							
o Work	2.57	2.57	4.13	4.13	2.44	3.66	3.66
o Non-Work	.24	.24	-.36	-.36	.71	.34	.34
o Air Passenger	.85	1.19	.45	.45	1.27	1.40	1.40
o Air Passenger Related	.09	.12	.05	.05	.13	.14	.14
<b>TOTAL</b>	<b>3.75</b>	<b>4.12</b>	<b>4.27</b>	<b>4.27</b>	<b>4.55</b>	<b>5.54</b>	<b>5.54</b>



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## ATTACHMENT D

# Comparison of Bay Area Costs to Costs in Other AA Cities

<u>AA City</u>	<u>Construction Cost Index (1)</u>	<u>Labor Cost Index (2)</u>	
		<u>Bus &amp; Trolley</u>	<u>Rail</u>
Boston	115.5		\$14.78
Buffalo	104.1		12.06
Pittsburgh	101.7		13.66
Atlanta	89.1		12.00
Cleveland	109.3		13.00
Minneapolis/St. Paul	99.1	\$14.12	
Austin, Texas	89.1	10.90	
Houston	92.1	12.21	
Denver	96.0	12.60	
Salt Lake City	92.8	10.22	
Honolulu	113.4	14.05	
Orange County	114.1	13.53	
Dallas	90.7	10.78	
AVERAGE	100.2	\$12.61	
		(compared to \$14.92 for BART)	
San Francisco	124.5		
San Francisco	126.3(3)		

(1) Building Construction Cost Data, 1988, Means, Kingston, MA--Noted Construction Cost data publisher.

(2) Top Hourly Wage Rates, APTA, Report No.s R8807,. B8807, July 1988.

(3) Engineering News Record, Construction Cost Index, September 1988; based on U.S. average of 20 cities.